

Fins, Feathers and Functional Flows

Multi-benefit Floodplain Management

Jacob Katz – California Trout



Photo: C. Jeffres



Managing Floodplains for Multiple Uses:



- Flood protection
- Agriculture
- Food web production
- Aquifer recharge
- Critical habitat for:
Native fish and wildlife



Fish Gotta Eat!

River



Floodplain

Feb 2014

Floodplains!

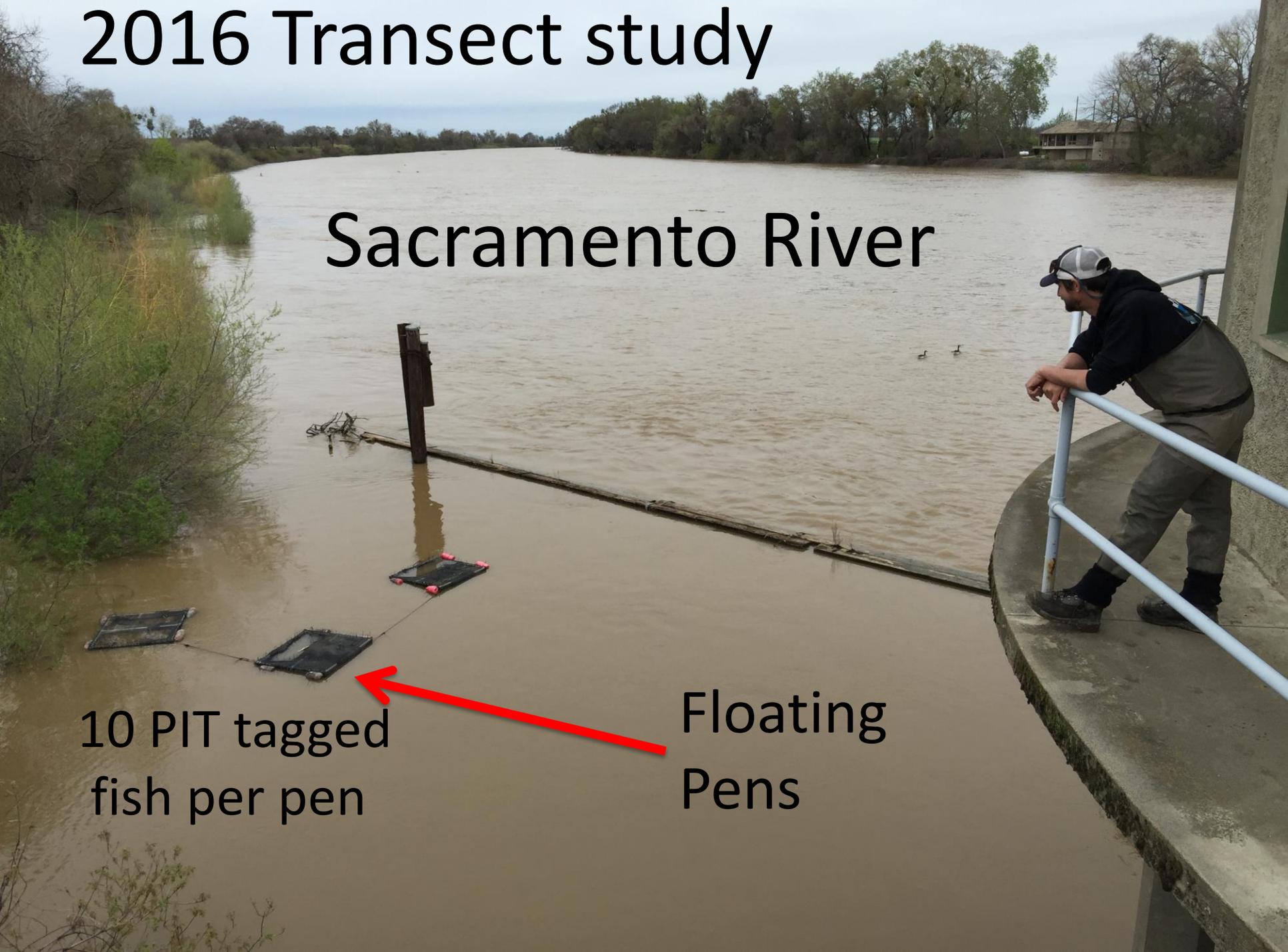


2016 Transect study

Sacramento River

10 PIT tagged
fish per pen

Floating
Pens



**Floating
Pens**



Tule Canal

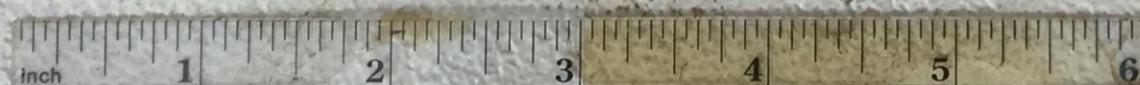
Managed Agricultural Floodplain At Knaggs Ranch on Yolo Bypass



Floodplain

Canal

River

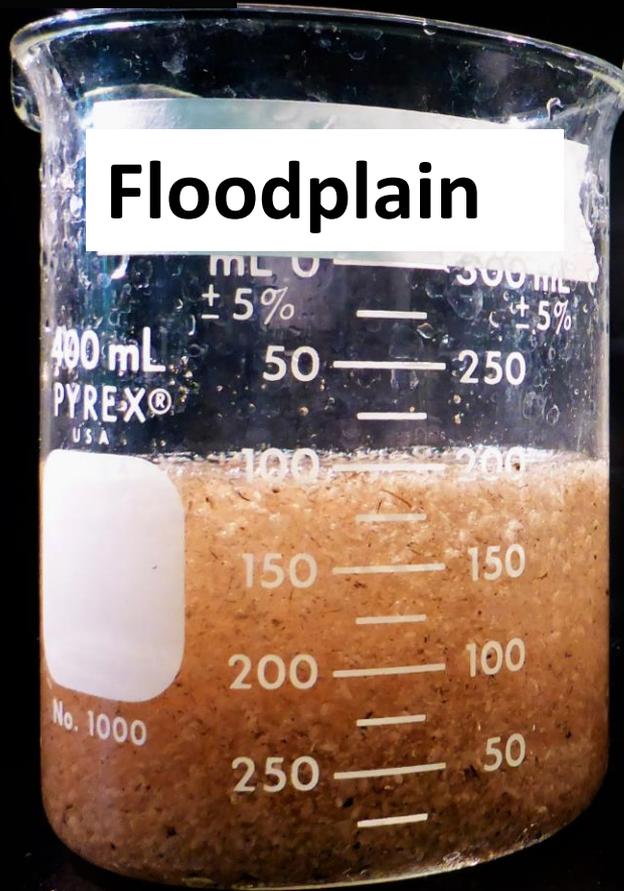


These fish were the same size 3 weeks prior to photo

Photo: J. Katz

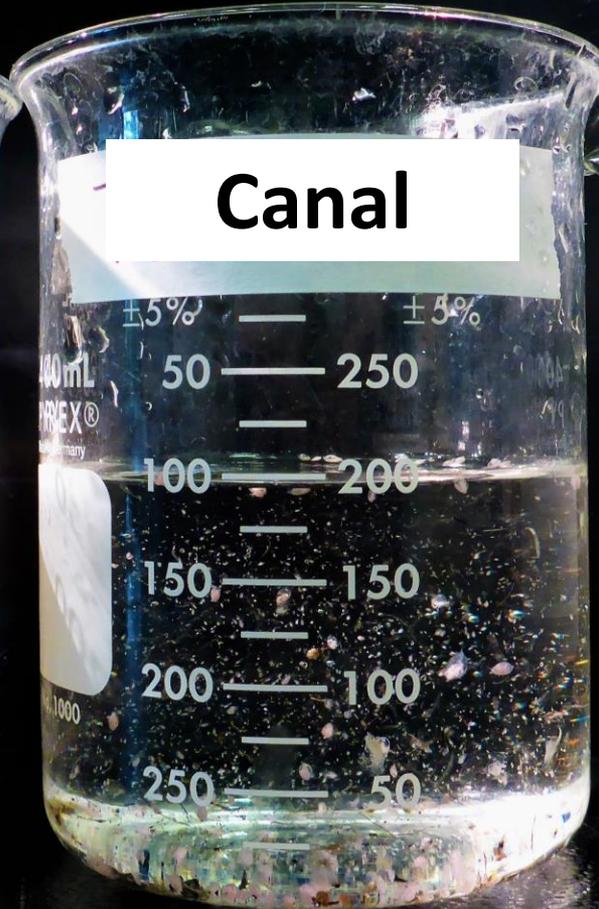
3-11-2016

The Food is on the Floodplain



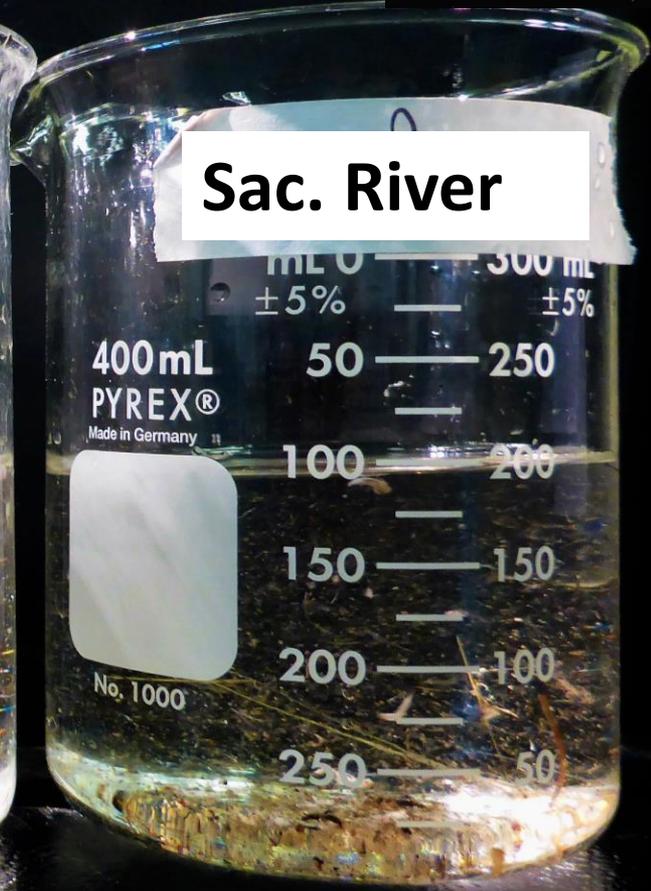
Total: 251,143/m³

149x



Total: 10,057/m³

6x



Total: 1,687/m³

x

Bug Density Across Habitats

Preliminary Results from
2016 Central Valley Riverine
Transect Study

Growth

700% the growth
in just 3 weeks

Weight (g)

Floodplain

Canal

River

Feb 22

Feb 29

Mar 07

Date



5

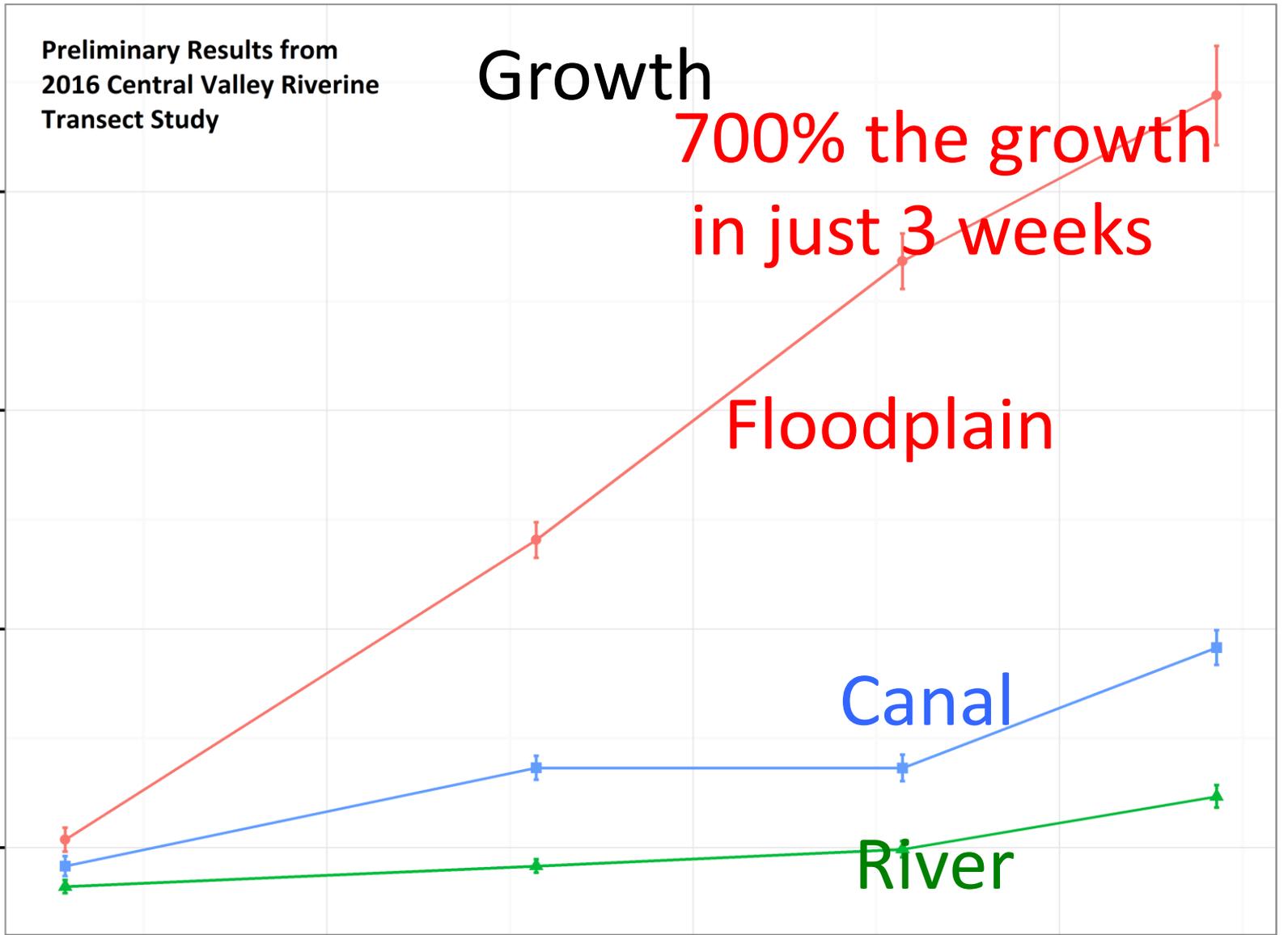
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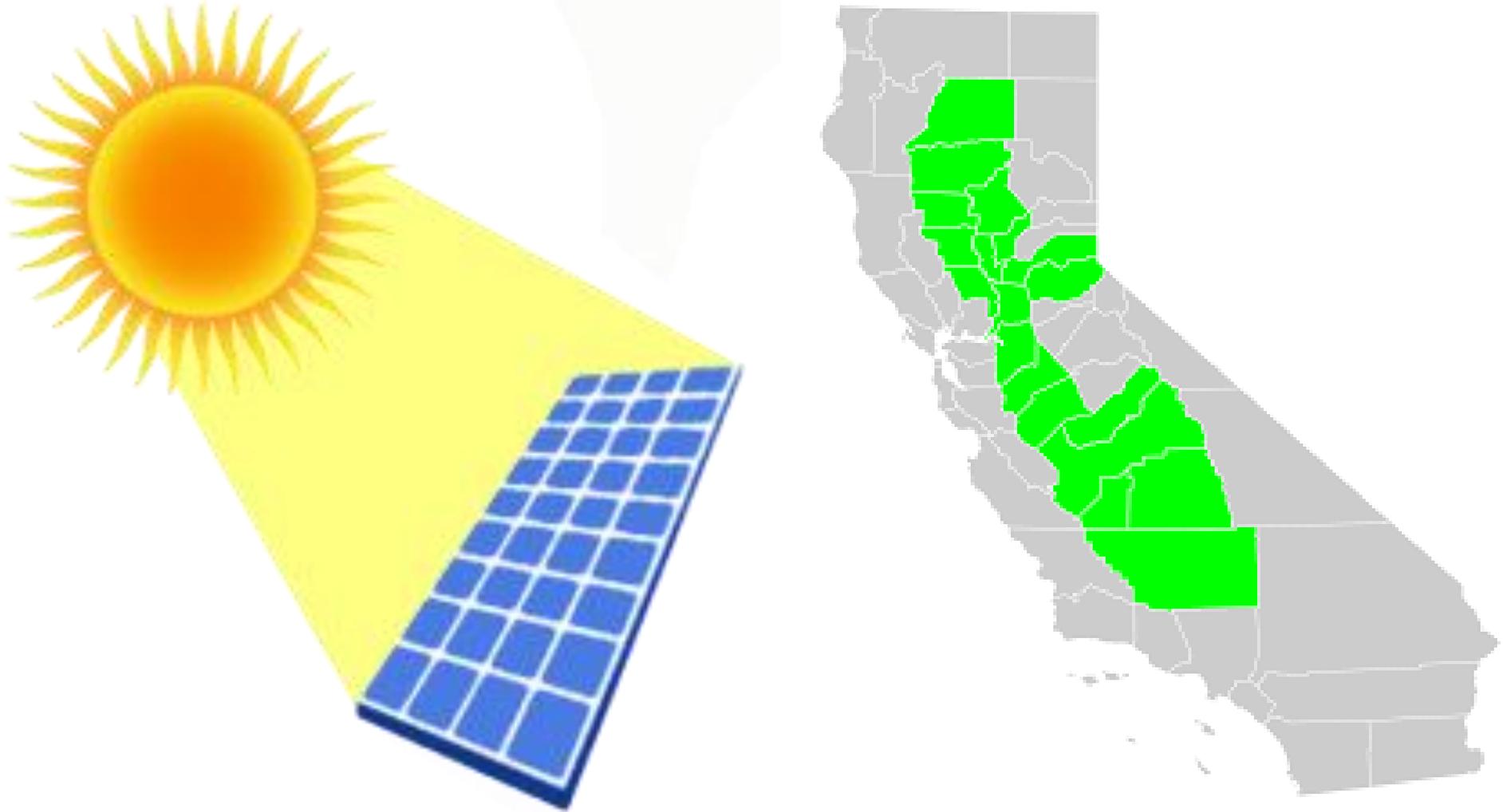
2

1

0

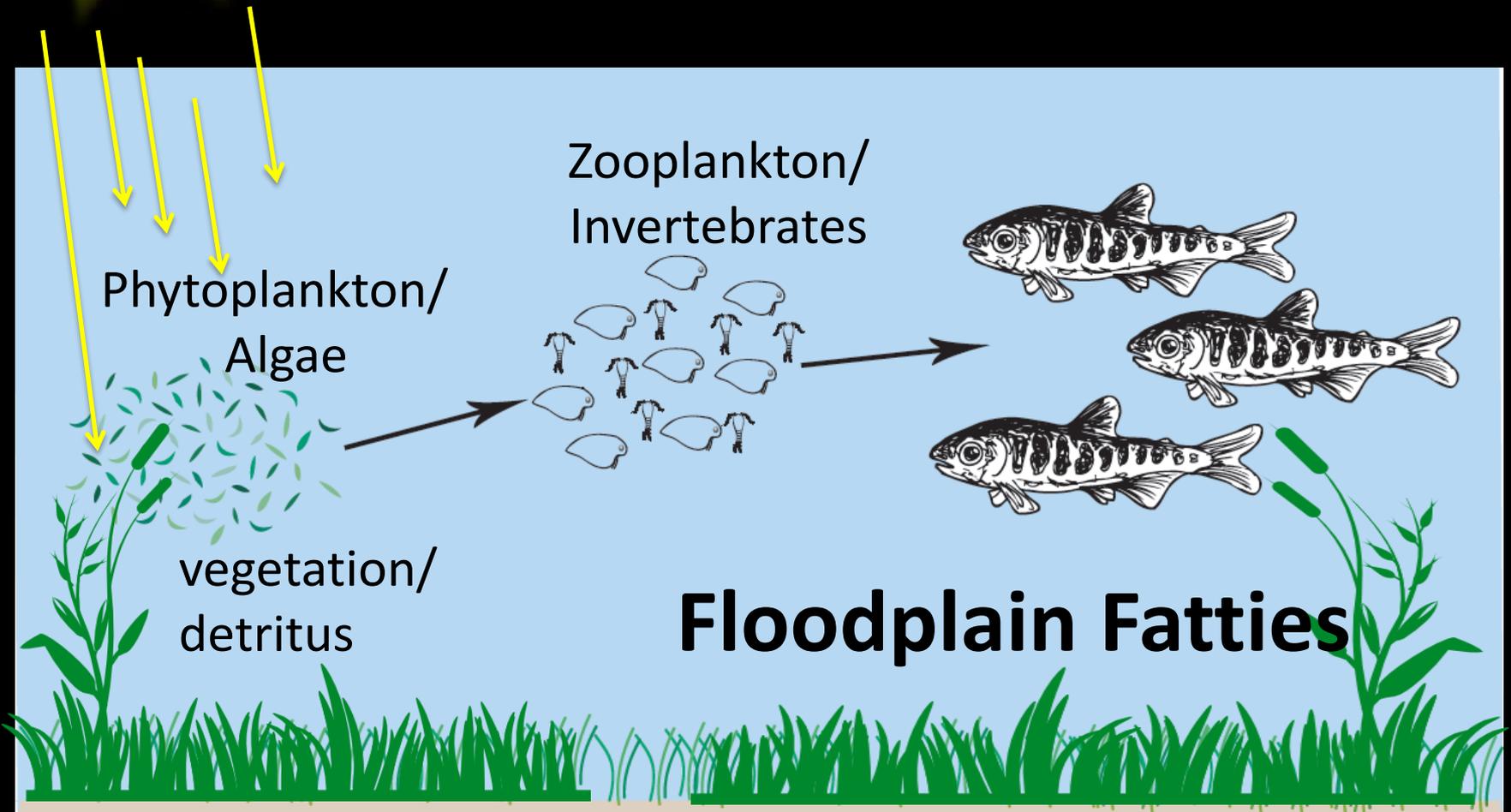


Floodplains are The Solar Panels

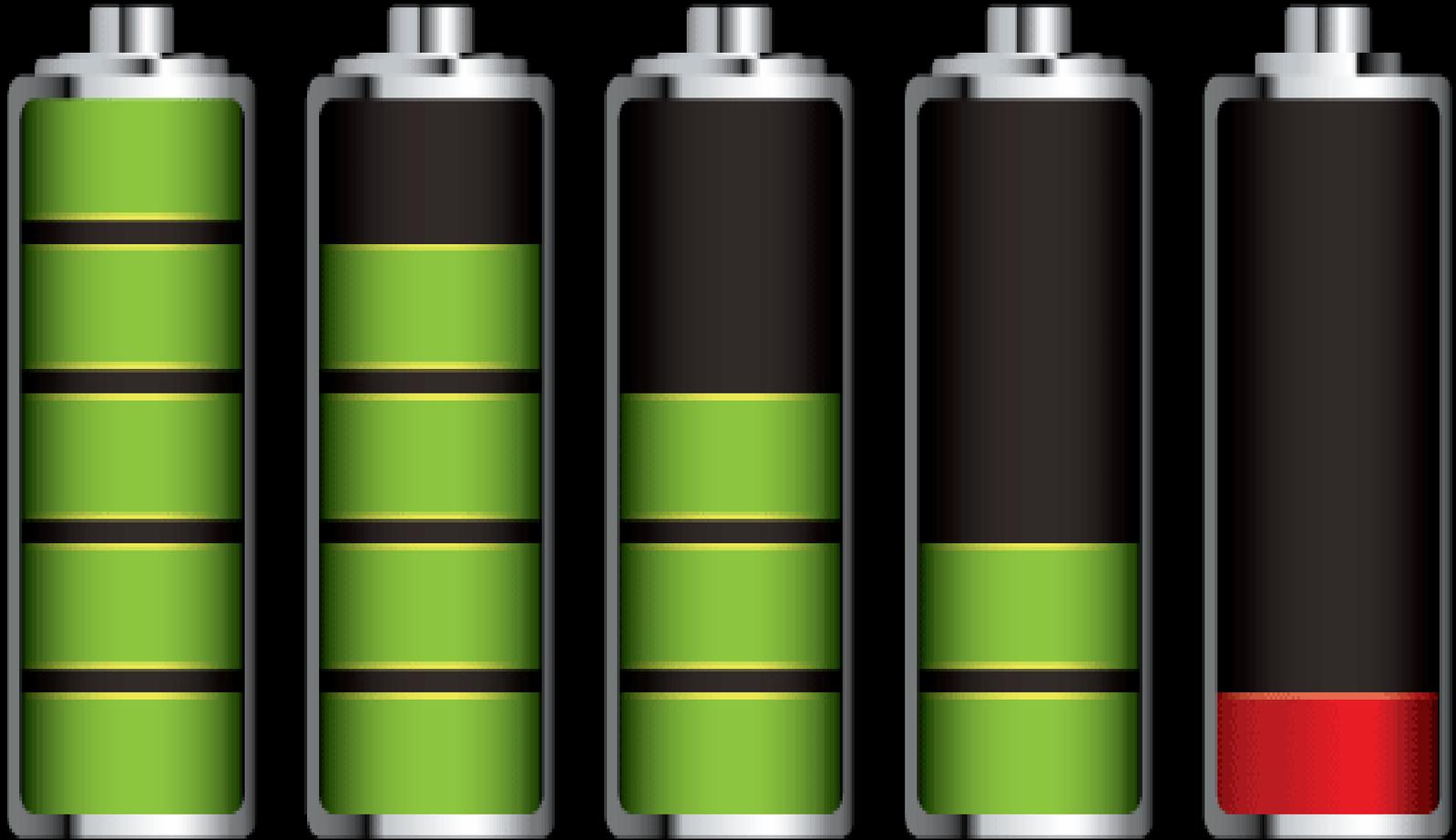


That Power River Food Webs

Mimicking Hydrologic Process To Restore Ecological Function



Loss of Seasonally Inundated Floodplain



Pre-development



Today

Ecosystem Running Out of Power!

Functional Flows

River

Fish Gotta Eat!



Floodplain

Feb 2014

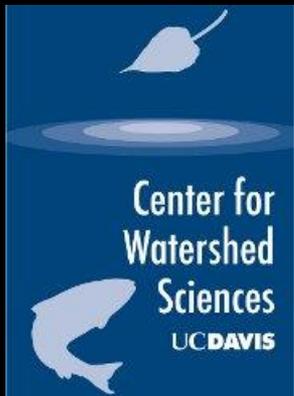


A Cooperative Partnership

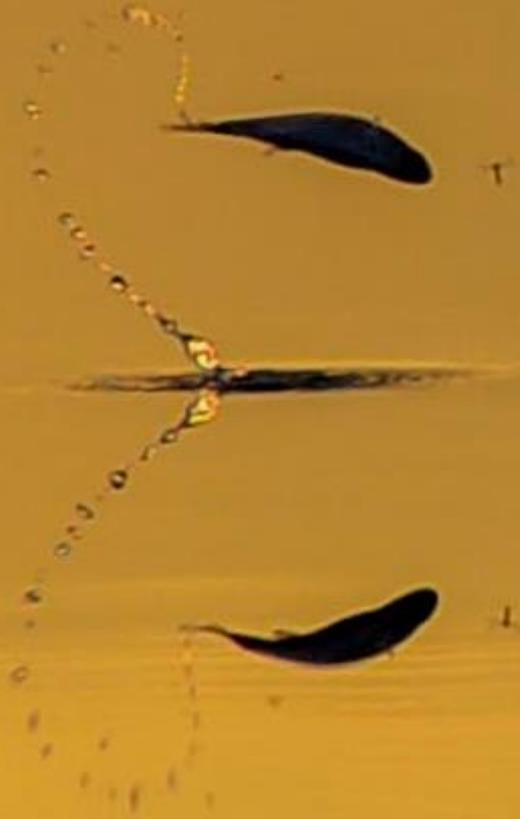
California Trout



The California Department of Water Resources
The UC Davis Center for Watershed Science
Cal Marsh and Farm Ventures, LLC
Knaggs Ranch & Conaway Ranch
The U.S. Bureau of Reclamation
NOAA – Southwest Fisheries



Questions?

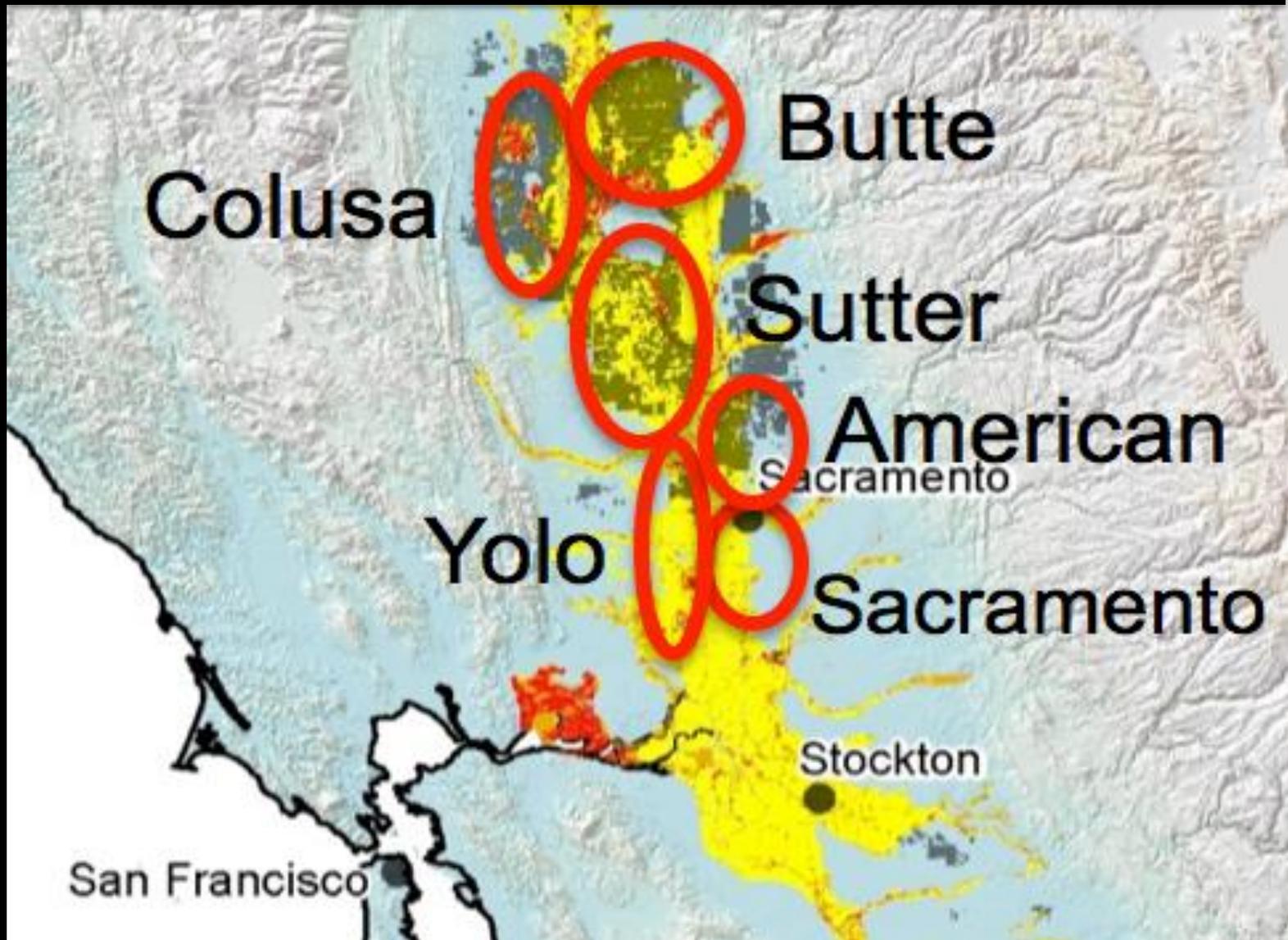


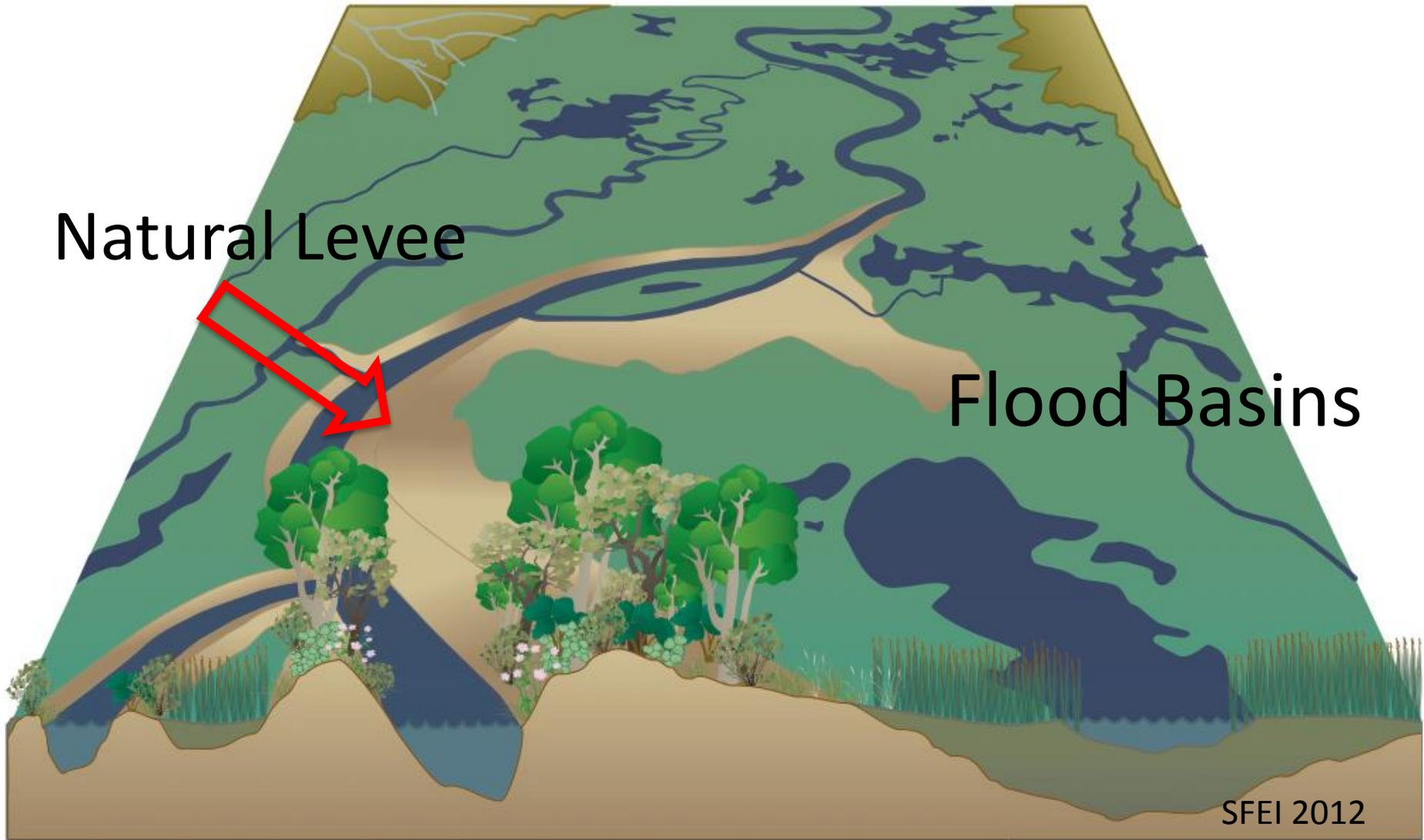
Carson Jeffres



Designing Water Solutions for California's Fish, Wildlife and People

Sac Valley = Flood Basins





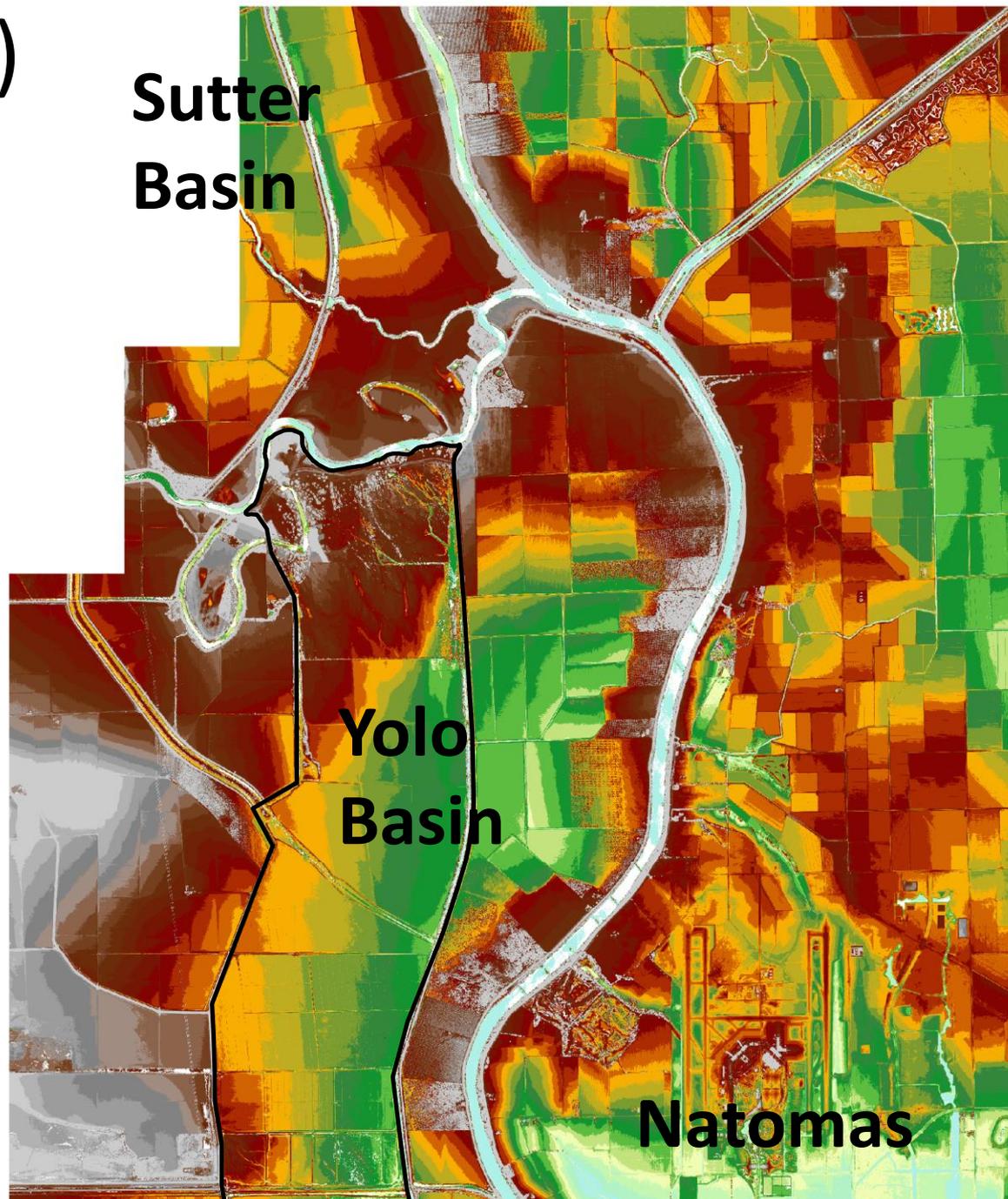
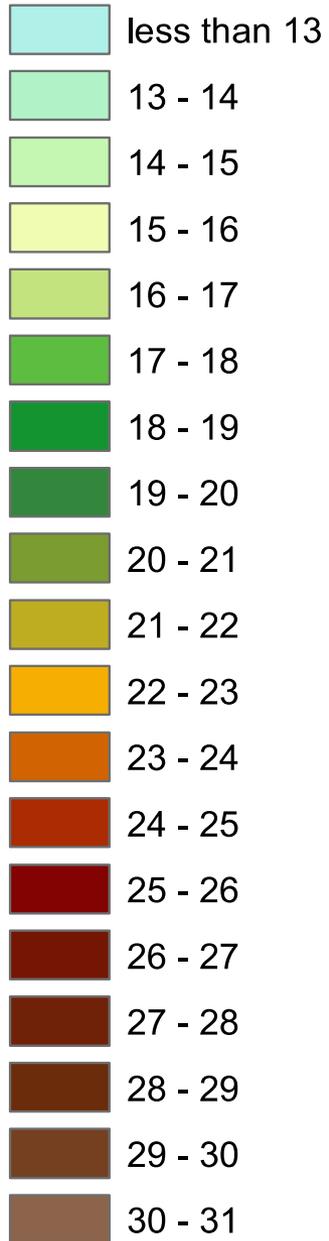
Natural Levee

Flood Basins

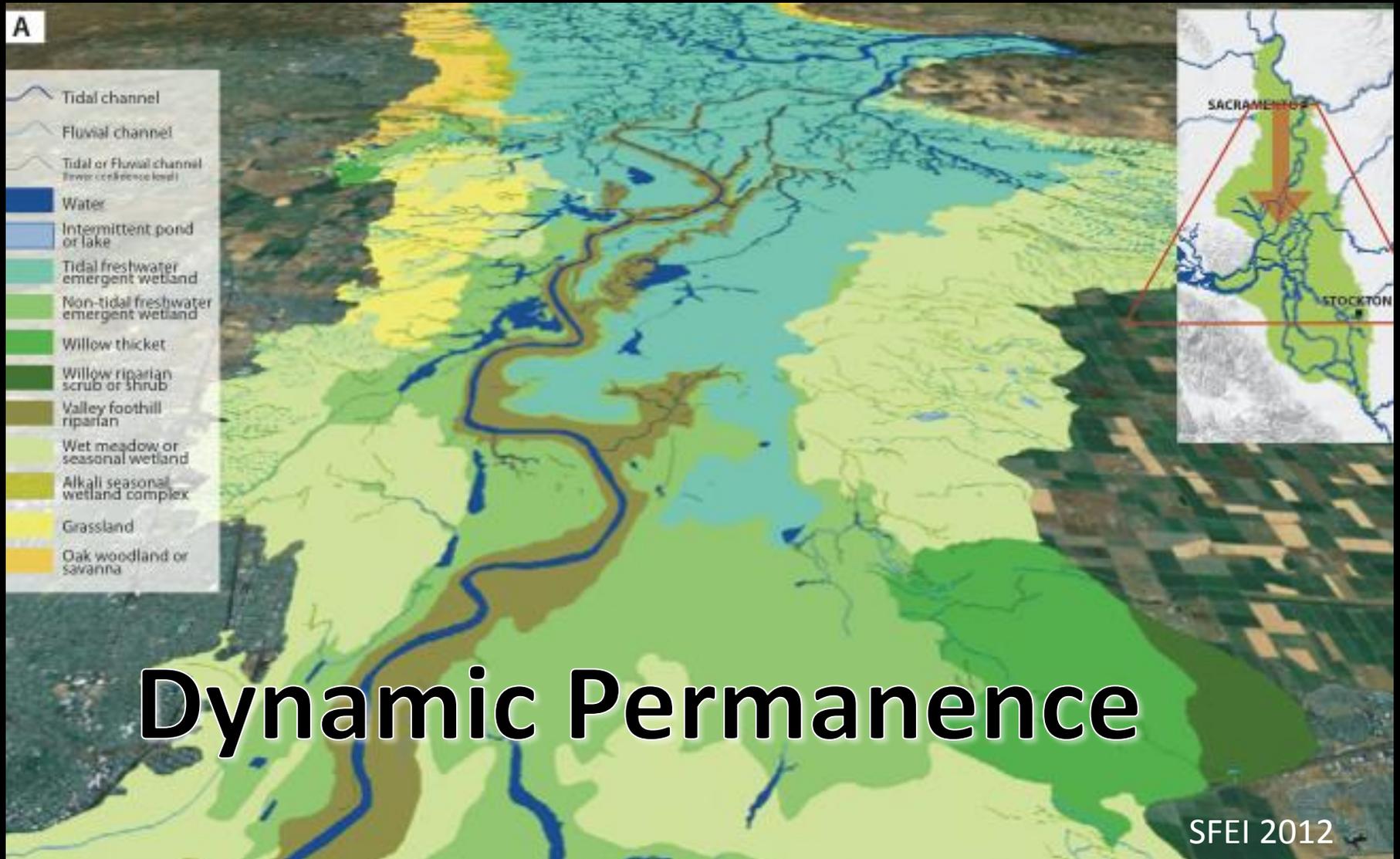
SFEI 2012

Fluvial Processes

Elevation (feet)



A Shifting Mosaic of Wetland Habitat Types



Reclamation

Mid 1800s – Early 1900s



13,000 miles of levees



Inland Sea



K. STREET, FROM THE LEVEE.

**INUNDATION OF THE STATE CAPITOL,
City of Sacramento, 1862.**

Published by AROSENFELD, San Francisco



J street



Flood of 1862

Drainage



Central Valley Chinook



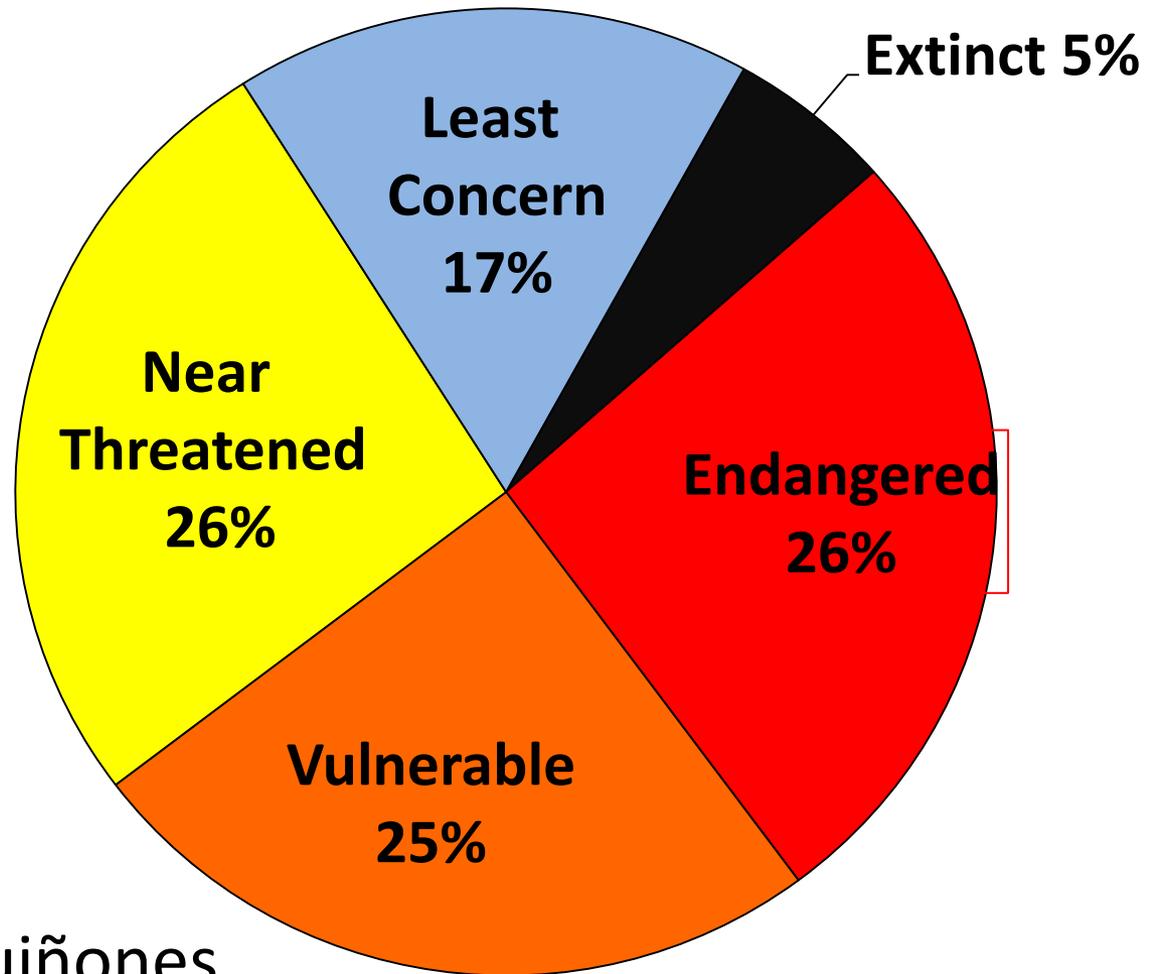
Of 4 runs

3 are endangered, the other is dominated by hatcheries



CA Native Fishes

CA NATIVE FISHES



83%

Extinct or
in decline

Moyle, Katz & Quiñones
Biological Conservation,
Vol 144, issue 10, Oct. 2011

N=129



We are never going back



American/ Natomas Basin

Yolo Basin

Sacramento Basin

© aerialarchives.com

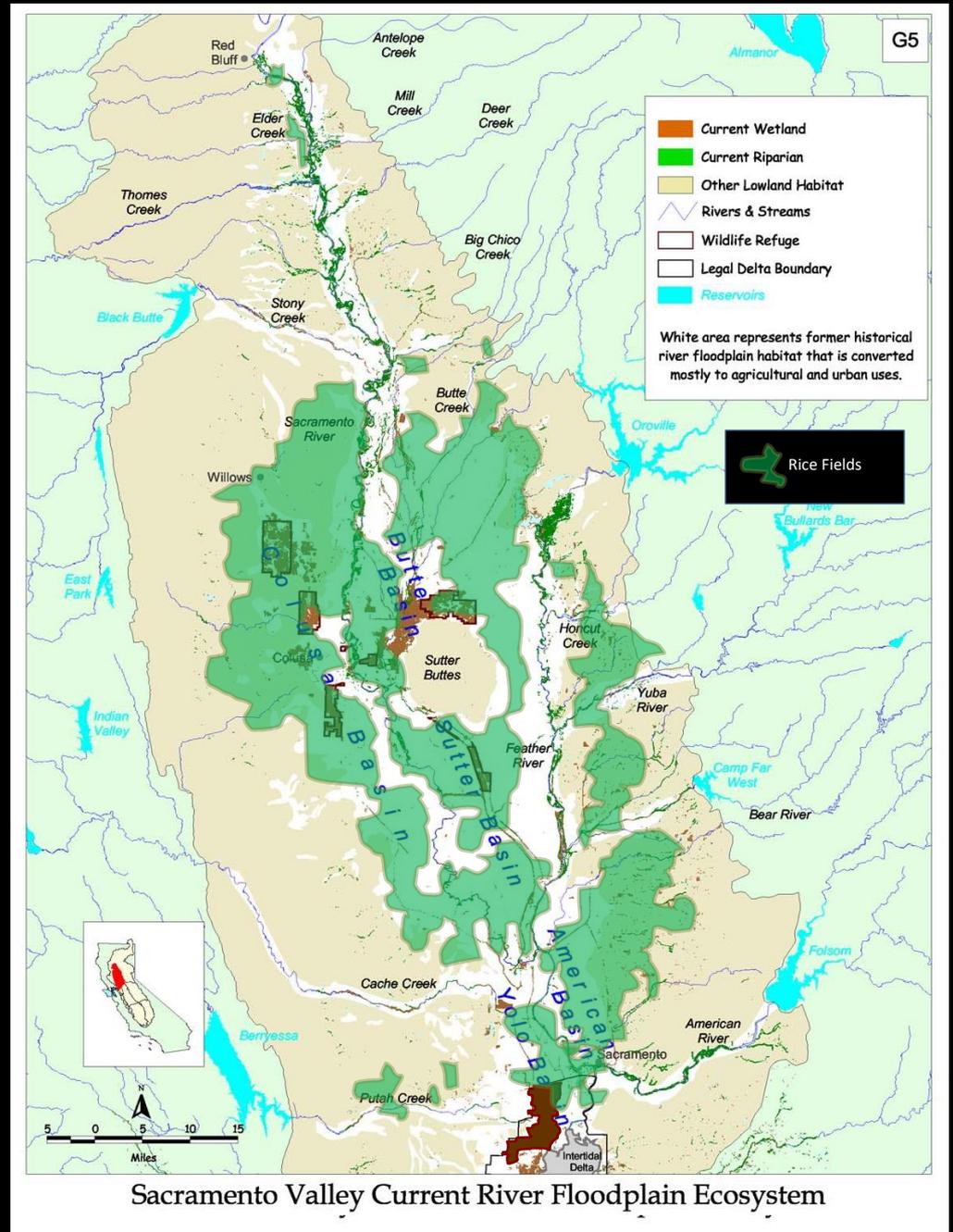


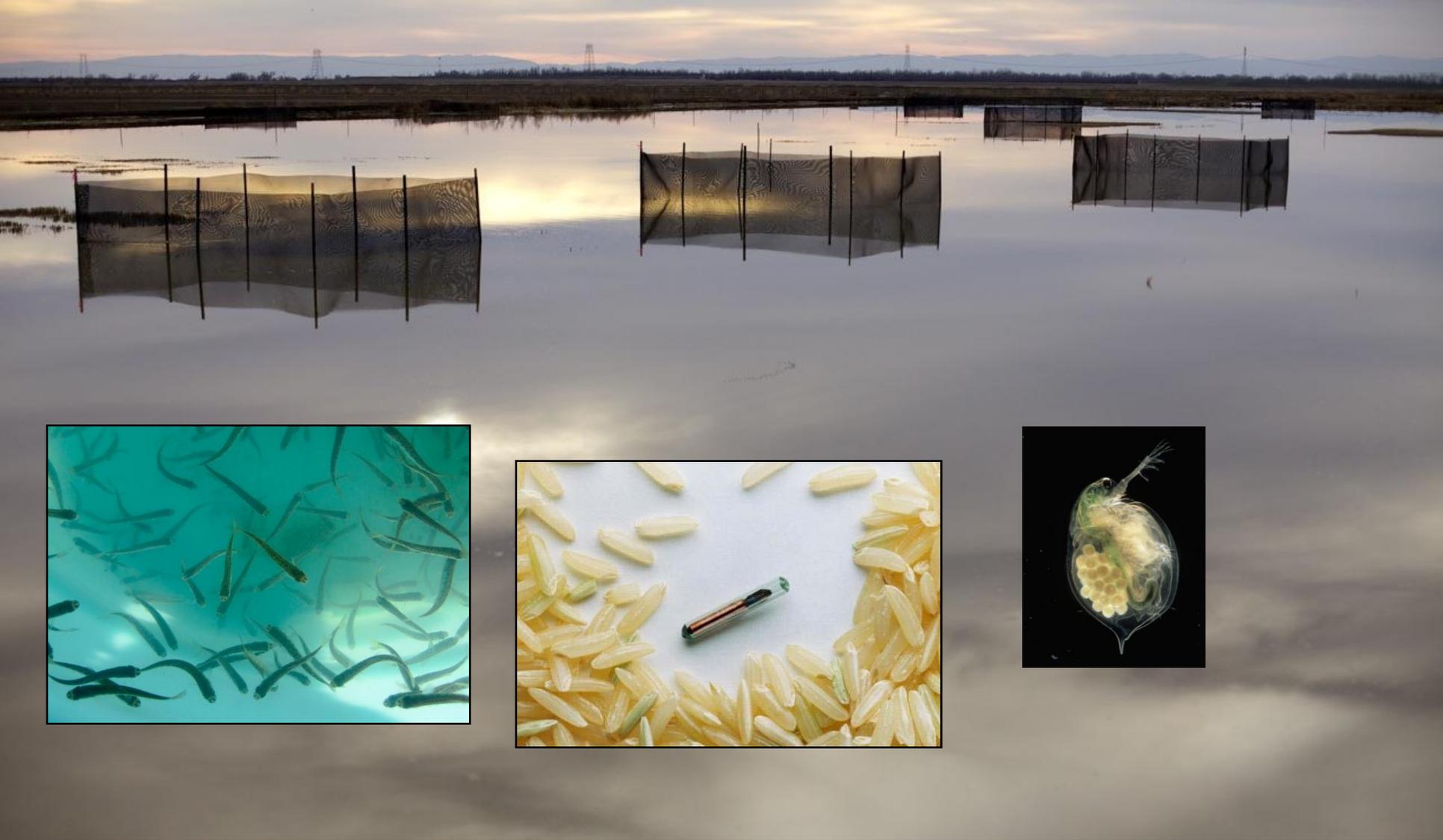
Historic:

Fall run Chinook evolved rearing on floodplains

TODAY:

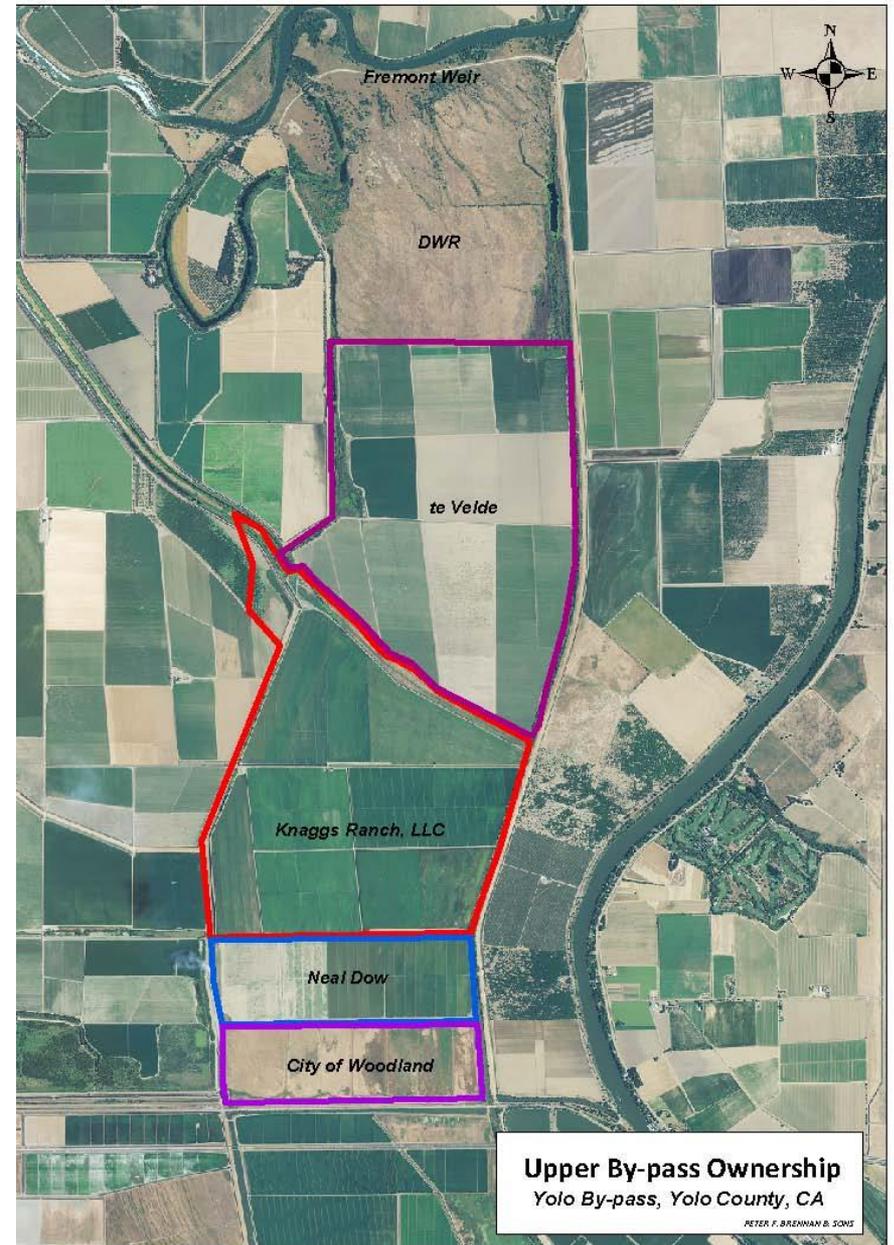
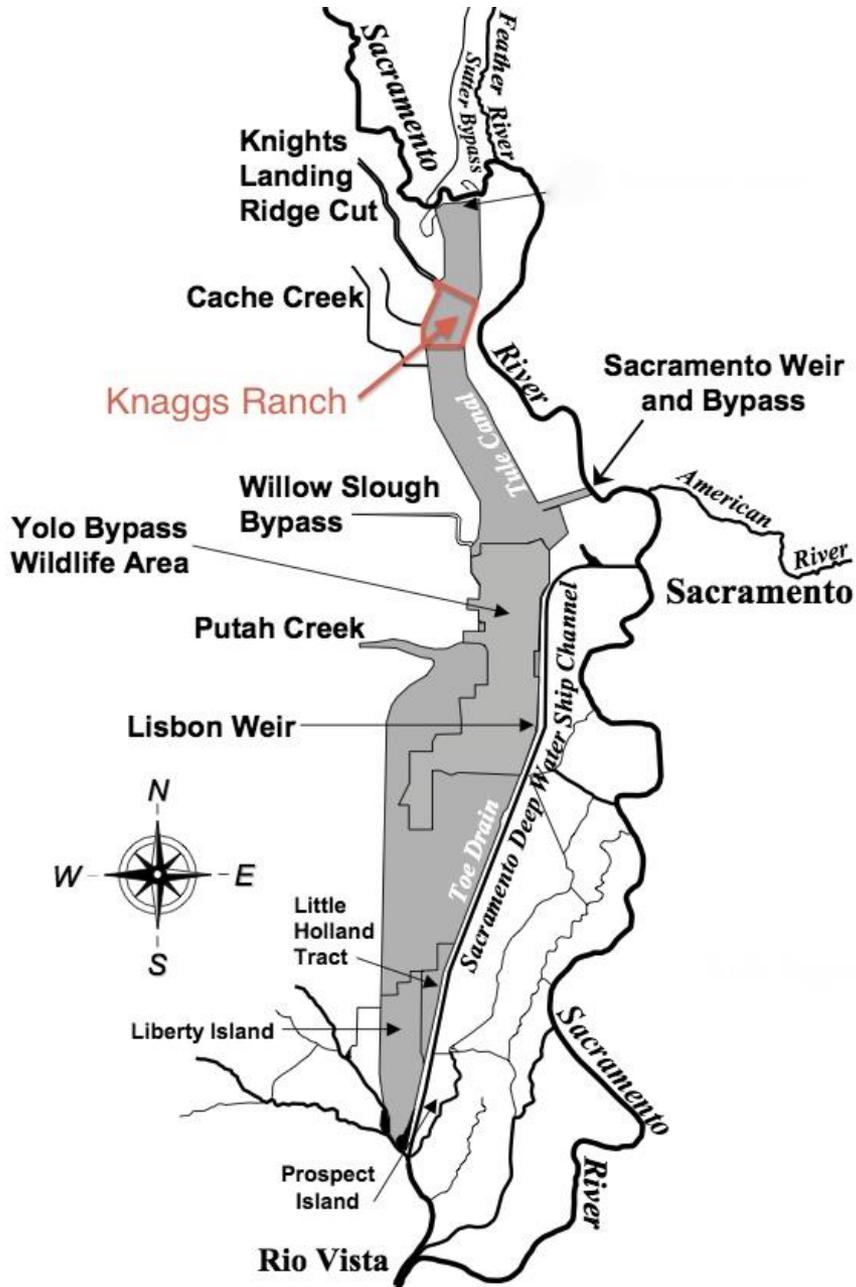
- **95%** of floodplains lost
- drained and converted to rice.
- In California 550,000 acres of rice is farmed annually.
- Now, many of the rice fields are managed for migrating birds during winter months.





Mimicking Hydrologic Process to Restore Ecological Function

Knaggs Ranch on Yolo Bypass





Nine 2-acre fields

Substrate type?



Fallow



Stubble



Stomped



Sbl

F

Smp

F

Sbl

Smp

Sbl

Smp

F

© 2013 Google

2013 Pilot Project
50 Acres

Knaggs Ranch

2013 to
2016:
Farm
Practices?

Replicated Ag Floodplains at Knaggs Ranch

Hypotheses tested

2013

Substrate effects

2014

Depth refugia

2015

Draining techniques

2016

Survival over time



Jan 31 – Week 0 – planted in rice field



March 12 – Week 6 – released from rice field



April 13 – Week 10 – 13 miles downstream

**G
R
O
W
T
H**

Day 0

Day 38

2013



3/19

53 mm

1.5 g

4/27

90 mm

9.4 g

0.94 mm/d

0.18 g/d



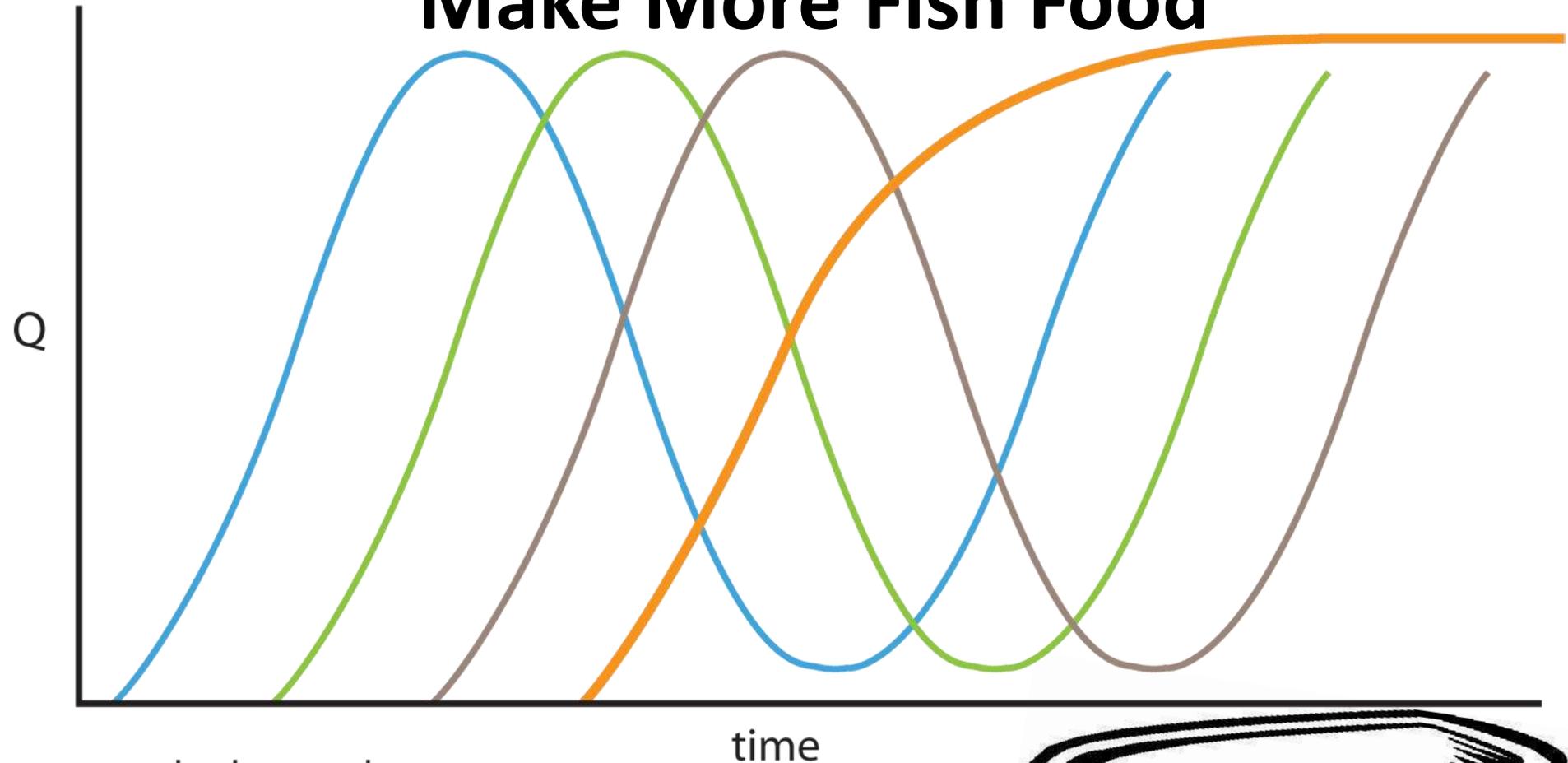
2014

**Similar Growth
(1 mm/day)**

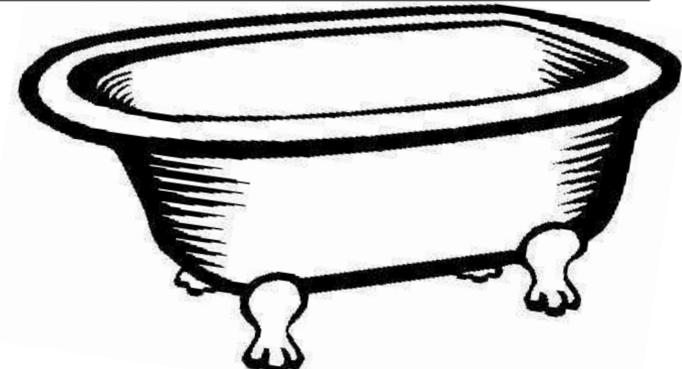
**Better
Survival**

(Approx. 50%)

Longer Residence Times Make More Fish Food



- hydrograph
- chlorophyll *a* & heterotrophs
- zooplankton
- fish benefit



Residence Time of Shallow Inundation



Spread it out—Slow it down—Grow them up

Process-Based Reconciliation

Integrating a working knowledge of natural process, into management of natural resources

